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ORIGINAL RESEARCH

Nasal Trauma Among Neonatal Intensive Care Unit Patients: A Retrospective Single Center Experience

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Background: Nasal trauma resulting from non-invasive ventilation in neonates admitted to intensive care units is a commonly underestimated complication.

Objectives: To measure the incidence, risk factors, and severity of nasal trauma among pediatric patients admitted to intensive care units.

Methods: A retrospective cross-sectional study was performed. Consultations and referrals by intensive care unit physicians to the otolaryngology department at a tertiary children's hospital in Dammam, Saudi Arabia, from April 2019 through October 2023 were reviewed. All patients with documented nasal trauma were eligible. External nasal examinations and anterior nasal endoscopy (0° telescope) with documentation of findings were performed on each patient.

Results: The cumulative incidence of nasal trauma among ENT referrals was 10.7%. Males predominated (58%), with a median birth weight of 1.38 kg. NIPPV was the most common ventilation type (79%), and adhesions were the most common trauma (58%). The median duration on CPAP/NIPPV before trauma was 15 days. Medical management included topical ointments and saline rinses (37%), while surgical release was performed in 21% of patients; 42% received no intervention.

Conclusion: Nasal trauma is relatively common among neonates requiring non-invasive ventilation in NICU settings. Multi-center studies with larger samples are recommended to better estimate incidence and improve preventive strategies.

Keywords: nasal trauma, ventilation, CPAP, NIPPV, neonate, NICU

Introduction

Almost all patients in intensive care units (ICUs) require some form of supplemental oxygen administration. These forms may be invasive through means of endotracheal intubation or noninvasive, including nasal cannulas, and nasal continuous positive airway pressure (CPAP).[1]

Nasal continuous positive airway pressure (nCPAP) is a commonly employed method for managing respiratory issues in pediatric patients.[2–7] While evidence suggests the use of NCPAP reduces the need for intubation and surfactant treatment in preterm infants,[8] several complications have been linked to its use.

Although complications such as gastric distension and air leaks have been extensively documented, there is limited information available regarding nasal trauma,[9] with only few studies in the literature linking various CPAP devices to nasal complications.[10–12] In a large prospective study that included 989 neonates who were treated with nCPAP, Nasal trauma was reported in 42.5%.[13]

Nasal trauma includes mucosal lacerations, adhesions, columellar erosions, and septal perforations. Its occurrence is influenced by the ventilation interface (eg, prongs vs masks), duration of use, and device size or fit. Understanding these associations is critical for improving neonatal outcomes and preventing deformities.[2–7]

Several risk factors associated with nasal injury from NCPAP were identified. These include lower gestational age, low birth weight, and duration of time on NCPAP. In addition to the aforementioned factors, incorrect application of the device, inadequate monitoring of skin and surrounding tissue, inappropriate size of prongs or mask, and inappropriate size and/or

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application of the head-securing device have been also identified to contribute to nasal injury.[14–18] Nasal trauma in intensive care settings can also result from improper suctioning techniques and nasal cannulas.

To our knowledge, there are no local studies documenting the incidence, risk factors, and sequel of nasal trauma among pediatric patients admitted to intensive care units in Saudi Arabia. This research aims to objectively measure the incidence, associated factors, and severity of nasal trauma among pediatric patients admitted to intensive care units.

Subjects and Methods

Approval was obtained before enrolling patients in this study from King Fahad special hospital Dammam's Institutional review board. A waiver of consent was granted since the study was considered "less than minimal risk" due to the retrospective nature of it. The study was conducted in accordance with the declaration of Helsinki. The hospital's health information system was used to retrospectively review all consultations and referrals conducted by the intensive care unit physicians for the otolaryngology department at a tertiary care children's hospital, Dammam, Saudi Arabia from April 2019 through October 2023.

All patients with a documented nasal trauma were considered eligible. Patients with preexisting nasal lesions (nasal aperture stenosis, mid-nasal stenosis, nasal adhesions, choanal stenosis/ atresia), were excluded. External nasal examinations and anterior nasal endoscopy (0° telescope) with documentation of intranasal findings were performed on each patient. A checklist was prepared to collect data about patents' age, gender, birth weight, days on cpap/nippv before trauma, trauma day of life, nasal ventilation type, trauma type, intervention and outcome.

Statistical analysis was performed using SPSS v26. Associations between categorical variables were tested using Fisher's exact test, while non-parametric quantitative comparisons used the Kruskal–Wallis test. P values < 0.05 were considered significant.

Results

Out of 178 consultations, 19 patients with documented nasal trauma were identified (10.7% of ENT referrals). Because the total number of NICU admissions during this period was unavailable, the calculated incidence reflects ENT referrals only. Majority of infants were pre-terms (73.7%). Most infants were males (58%) and had a median birth weight of 1.38 kg. Infants spent a median of 15 days on CPAP/NIPPV before trauma ensued.

Nasal ventilation types varied, with NIPPV being the most common (79%). Documented Traumas included adhesions (58%), mucosal laceration (42%), collumellar erosions (5.3%), and septal perforations (5.3%).

Interventions performed included medical management in the form of topical ointments and saline rinses (37%), surgical release, either bedside with speculum or endoscopic transnasal release with nasal stent, (21%) with 42% of patients with no intervention received. Approximately 42% experienced complete resolution, while 16% had partial resolution. About 21% had no evaluation or follow-up. (Table 1).

Despite males having a higher prevalence of medical interventions compared to females in our sample, this association was not significant ($p \leq 0.05$). Having adhesion or mucosal laceration as nasal trauma was associated with medical intervention and no surgical intervention respectively ($p<0.05$) (Tables 2 and 3).

Discussion

This study identified a 10.7% incidence of nasal trauma among neonates referred to ENT for assessment, consistent with prior research showing rates from 10% to 40%. The lower observed rate may reflect underreporting of mild cases managed directly by NICU staff. An earlier study found a higher prevalence, with 30% of infants in the intensive care unit having nasal traumas.[19] Other studies reported varied results with reported incidence ranging from 19.6% to as high as 91.6%.[20–22]

Most of our sample (63.4%) were less than 33 weeks old at the time of trauma, with a median birth weight of 1.38 (0.84) kg.

Lower birth weight and gestational age (premature) were identified as risk factors for nasal damage.[19,23] Fischer et al[13] and Imbulana et al[24] found that nasal damage was more likely to occur in newborns with gestational age less than 32 weeks, in whom underwent NIV treatment.

Table 1 Characteristics of Infant with Nasal Trauma

Characteristic	N = 19[a]
Age (in weeks)	
25	2 (11%)
27	3 (16%)
28	3 (16%)
29	1 (5.3%)
30	2 (11%)
33	1 (5.3%)
34	1 (5.3%)
36	1 (5.3%)
40	5 (26%)
Age group	
≤33	12 (63.4)
>33	7 (36.6)
Gender	
Female	8 (42%)
Male	11 (58%)
Birth weight (kg)	1.38 (0.84, 2.17)
Days on cpap/nippv before trauma	15 (8, 22)
Trauma day of life	23 (10, 49)
Nasal ventilation type	
CPAP	1 (5.3%)
Nasal cannula	1 (5.3%)
NIPPV	15 (79%)
NIPPV/ CPAP	1 (5.3%)
NIPPV/ high flow nasal canula	1 (5.3%)
Trauma type	
Adhesions	11 (58%)
Mucosal laceration	8 (42%)
Collumellar erosions	1 (5.3%)
Sptal perforation	1 (5.3%)
Intervention	
Medical	7 (37%)
Surgical release	4 (21%)

(*Continued*)

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Table 1 (Continued).

Characteristic	N = 19[a]
None	8 (42%)
Outcome	
Complete resolution	8 (42%)
No evaluation	4 (21%)
No follow up	4 (21%)
Partial resolution	3 (16%)
Surgical intervention	
Bed side with speculum	2 (50%)
Endoscopic transnasal release with nasal stent	2 (50%)
Unknown	15

Note: [a](%); Median (IQR).

Table 2 Association of Nasal Trauma Outcome with the Characteristics of Infants

Characteristic	Outcome				
	Complete Resolution, N = 8[a]	No Evaluation, N = 4[a]	No Follow Up, N = 4[a]	Partial Resolution, N = 3[a]	p-value[b]
Age (in weeks)					
25	1 (13%)	0 (0%)	1 (25%)	0 (0%)	0.2
27	3 (38%)	0 (0%)	0 (0%)	0 (0%)	
28	1 (13%)	1 (25%)	1 (25%)	0 (0%)	
29	1 (13%)	0 (0%)	0 (0%)	0 (0%)	
30	0 (0%)	0 (0%)	0 (0%)	2 (67%)	
33	1 (13%)	0 (0%)	0 (0%)	0 (0%)	
34	0 (0%)	0 (0%)	0 (0%)	1 (33%)	
36	0 (0%)	1 (25%)	0 (0%)	0 (0%)	
40	1 (13%)	2 (50%)	2 (50%)	0 (0%)	
Gender					
Female	3 (38%)	3 (75%)	1 (25%)	1 (33%)	0.6
Male	5 (63%)	1 (25%)	3 (75%)	2 (67%)	
Birth weight (kg)	1.09 (0.86, 2.03)	2.07 (1.58, 2.40)	1.81 (1.23, 2.43)	0.80 (0.75, 1.10)	0.3
Days on cpap/nippv before trauma	14 (11, 24)	6 (3, 12)	14 (9, 24)	20 (18, 29)	0.3
Trauma day of life	29 (11, 49)	12 (3, 27)	21 (15, 25)	56 (53, 57)	0.050

(*Continued*)

Table 2 (Continued).

Characteristic	Outcome				
	Complete Resolution, N = 8[a]	No Evaluation, N = 4[a]	No Follow Up, N = 4[a]	Partial Resolution, N = 3[a]	p-value[b]
Nasal ventilation type					
CPAP	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0.8
Nasal cannula	1 (13%)	0 (0%)	0 (0%)	0 (0%)	
NIPPV	6 (75%)	3 (75%)	3 (75%)	3 (100%)	
NIPPV/ CPAP	1 (13%)	0 (0%)	0 (0%)	0 (0%)	
NIPPV/ high flow nasal canula	0 (0%)	1 (25%)	0 (0%)	0 (0%)	
Adhesions					
No	4 (50%)	4 (100%)	0 (0%)	0 (0%)	0.007
Yes	4 (50%)	0 (0%)	4 (100%)	3 (100%)	
Mucosal laceration					
No	4 (50%)	0 (0%)	4 (100%)	3 (100%)	0.007
Yes	4 (50%)	4 (100%)	0 (0%)	0 (0%)	
Collumellar erosions					
No	8 (100%)	4 (100%)	4 (100%)	2 (67%)	0.2
Yes	0 (0%)	0 (0%)	0 (0%)	1 (33%)	
Septal perforation					
No	8 (100%)	4 (100%)	4 (100%)	2 (67%)	0.2
Yes	0 (0%)	0 (0%)	0 (0%)	1 (33%)	
Surgical intervention					
Bed side with speculum	0 (0%)	0 (NA%)	1 (100%)	1 (50%)	0.9
Endoscopic transnasal release with nasal stent	1 (100%)	0 (NA%)	0 (0%)	1 (50%)	
Unknown	7	4	3	1	
Intervention					
Medical	5 (63%)	0 (0%)	1 (25%)	1 (33%)	0.061
None	2 (25%)	4 (100%)	2 (50%)	0 (0%)	
Surgical release	1 (13%)	0 (0%)	1 (25%)	2 (67%)	

Notes: [a](%); Median (IQR), [b] Fisher's exact test; Kruskal–Wallis rank sum test.

One possible explanation for these observations is that preterm infants' skin is immature and vulnerable, with a growing epidermis with just two or three layers of cells and scant keratinization. Only about the 34th week of gestation is the stratum corneum expected to fully develop, making the skin less prone to harm.[25] Thus, frequent suggestions for preventing NIV-related nasal damage include careful monitoring of the nose and avoiding pressure, friction, and moisture.[26]

Table 3 Association of Nasal Trauma Intervention with the Characteristics of Infants

Characteristic	Intervention			
	Medical, N = 7[a]	None, N = 8[a]	Surgical Release, N = 4[a]	p-value[b]
Age (in weeks)				
25	1 (14%)	0 (0%)	1 (25%)	0.3
27	2 (29%)	1 (13%)	0 (0%)	
28	0 (0%)	2 (25%)	1 (25%)	
29	1 (14%)	0 (0%)	0 (0%)	
30	1 (14%)	0 (0%)	1 (25%)	
33	1 (14%)	0 (0%)	0 (0%)	
34	0 (0%)	0 (0%)	1 (25%)	
36	0 (0%)	1 (13%)	0 (0%)	
40	1 (14%)	4 (50%)	0 (0%)	
Gender				
Female	1 (14%)	6 (75%)	1 (25%)	0.051
Male	6 (86%)	2 (25%)	3 (75%)	
Birth weight (kg)	1.40 (0.90, 2.05)	2.02 (1.17, 2.40)	0.77 (0.73, 0.95)	0.062
Days on cpap/nippv before trauma	12 (9, 22)	11 (5, 19)	29 (19, 38)	0.11
Trauma day of life	30 (10, 42)	22 (14, 28)	55 (42, 56)	0.2
Nasal ventilation type				
CPAP	0 (0%)	1 (13%)	0 (0%)	0.9
Nasal cannula	1 (14%)	0 (0%)	0 (0%)	
NIPPV	5 (71%)	6 (75%)	4 (100%)	
NIPPV/ CPAP	1 (14%)	0 (0%)	0 (0%)	
NIPPV/ high flow nasal canula	0 (0%)	1 (13%)	0 (0%)	
Adhesions				
No	2 (29%)	6 (75%)	0 (0%)	0.040
Yes	5 (71%)	2 (25%)	4 (100%)	
Mucosal laceration				
No	5 (71%)	2 (25%)	4 (100%)	0.040
Yes	2 (29%)	6 (75%)	0 (0%)	
Collumellar erosions				
No	6 (86%)	8 (100%)	4 (100%)	0.6
Yes	1 (14%)	0 (0%)	0 (0%)	

(*Continued*)

Table 3 (Continued).

Characteristic	Intervention			
	Medical, N = 7[a]	None, N = 8[a]	Surgical Release, N = 4[a]	p-value[b]
Septal perforation				
No	6 (86%)	8 (100%)	4 (100%)	0.6
Yes	1 (14%)	0 (0%)	0 (0%)	
Surgical intervention				
Bed side with speculum	0 (NA%)	0 (NA%)	2 (50%)	>0.9
Endoscopic transnasal release with nasal stent	0 (NA%)	0 (NA%)	2 (50%)	
Unknown	7	8	0	

Notes: [a](%); Median (IQR), [b]Fisher's exact test; Kruskal–Wallis rank sum test.

Most infants with nasal trauma in the present study were males (58%). The same result was observed in a previous study, where female gender was associated with a decrease in odds to develop nasal injuries.[27]

The median number of days spent on cpap/nippv prior to trauma in the current study was 15 days. In a study conducted by Yong et al, the duration of nCPAP was the only significant risk factor linked with nasal damage.[12] Using the same device for extended periods of time may result in continuous pressure on the same areas of the nose, causing redness and indentation of the nasal bridge – a moderate injury – within one day of starting nCPAP.[27,28]

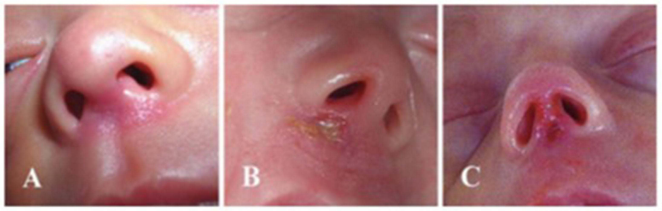
NIPPV was the most common method of nasal ventilation among the individuals evaluated in our study (79%). Neonatal NIPPV was initially administered through a face mask, but the approach fell out of favor after case reports of head molding and cerebellar hemorrhages.[29] Currently, NIPPV is administered by nasal prongs. Fischer et al[13] studied 989 infants who received NIV using a nasal prong and found a 42.5% prevalence of nose damage. Sousa et al[29] evaluated 47 premature infants on NIV with nasal prongs and found a greater frequency of nasal damage in 68.1% of the newborns studied. Bonfim et al[30] discovered that in 70 newborns who used fresh or reused nasal prongs, the incidence of nose damage was 62.9%, with no difference between groups or types of interfaces.

Nasal masks, RAM cannulas,[31] cannulas with long and narrow tubing and short binasal prongs, and masks[32] are all popular NIV interfaces used in NICU settings. It is critical to select the appropriate interface and size for NIV success and to minimize nasal injuries that can result in stress, hyperemia, congestion, discomfort, and deformity.[13]

Jatana et al (2010) found that in the 182 nostrils investigated, the incidence of intranasal abnormalities linked to CPAP use comprised ulceration in 6 nasal cavities (3.3%), granulation in 3 nasal cavities (1.6%), and vestibular stenosis in 4 nasal cavities (2.2%).[1] In our study, Adhesions (58%), mucosal laceration (42%), collumellar erosions (5.3%), and septal perforation (5.3%) were the most prevalent types of traumata in the newborns investigated. Fischer et al[13] described 4 stages of nasal trauma in neonates on continuous positive airway pressure. Ranging from stage 0 with intact skin to stage III with full thickness of skin necrosis (Figure 1). The vast majority of nasal trauma in our study was advanced in the form of adhesions, erosions due to the fact that simple traumas identified were managed by NICU team without contacting ENT team. The current NICU protocol at our institution relies on regular nasal inspection, saline rinses, and antibiotic ointment as an initial management, in case of no improvement or progression in injury, an ENT consultation to be done for full assessment and management.

Management strategies in our cohort varied from conservative therapy (saline and topical ointments) to surgical release under direct or endoscopic visualization. Conservative therapy was effective for most mild-to-moderate injuries.

Commonly used evidence-based techniques for managing nasal trauma include alternating between nasal prongs and masks, using soft silicone or latex devices, tightly controlling incubator humidity and temperature, providing adequate nutritional support, using barrier dressings, and performing frequent skin checks.[33] Magalhães et al (2022) found that



Stage 0	Intact, non-compromised skin
Stage I	Non-blanching erythema
Stage II	Superficial erosion
Stage III	Necrosis of full thickness of skin

Figure 1 Classification of nasal trauma tool. Adapted from "Nasal trauma due to continuous positive airway pressure in neonates", Fischer et al (2010). Archives of Disease in Childhood e Fetal and Neonatal Edition, (95) F447eF4.

using rotating nasal masks with prongs lowers the risk of mild to severe nasal mucosal damage compared to single devices.[34]

Our findings emphasize the clinical relevance of early detection and multidisciplinary management to prevent long-term deformities. Future multicenter, prospective studies should quantify total NICU incidence and evaluate standardized prevention protocols.

Limitations

This single-center, retrospective study reviewed only referred cases; thus, mild injuries managed independently by NICU staff were not captured. The sample size was limited, and total NICU census data were unavailable, limiting incidence generalization.

Conclusion

Nasal trauma is a frequent complication among neonates requiring non-invasive ventilation. While most cases resolve with conservative measures, early recognition and preventive strategies are essential. Multicenter research is warranted to establish accurate incidence rates and develop evidence-based prevention guidelines.

Disclosure

The authors report no conflicts of interest in this work.

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